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FIELD EVALUATION OF THE GROWTH REGULATOR UNICONAZOLE (XE-1019)

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ABSTRACT

A long-term field study was initiated in the spring of 1988 to evaluate the effectiveness of the growth regulator uniconazole (XE-1019), applied by trunk injection, as an inhibitor of the growth of trimmed trees. Uniconazole was applied to mature Norway maple and green ash trees growing in Toronto and London respectively. Injection times were short in the maples and longer in the ash (mean time of 8 and 26 minutes, respectively). After injection some holes in the maple trees bled, but none in the ash. Little growth (measured as increase in overall height or in trunk diameter) was observed in the maple and ash trees in the 3 months after the injection, with the exception of the increase in overall height of the former. Growth will be measured in 1989 and subsequently.

job	file	date	report no.
34-132-241	834.1	November 17, 1988	88-226-K

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EXECUTIVE SUMMARY

FIELD EVALUATION OF THE GROWTH REGULATOR UNICONAZOLE (XE-1019)

Approximately 1 million trees under or beside distribution lines are trimmed or removed by Ontario Hydro every year. The frequency of trimming depends on factors such as species, location, orientation to line and rate of regrowth. A reduction in the rate of regrowth would allow the frequency of trimming to be reduced and savings in costs to be achieved.

Growth regulators, such as paclobutrazol (PP 333), flurprimidol (EL-500) and uniconazole (XE-1019) have been reported to inhibit tree growth in a number of US and Canadian studies. Of the various application methods used in these studies trunk injection offers advantages over the other methods in that chemical contact with non-target plants is prevented and environmental residues are reduced.

In a field study, requested by Distribution Systems Division, trunk injection of the growth regulator uniconazole (XE-1019) is being evaluated as a method of inhibiting growth in trimmed trees in southern Ontario. The study was initiated in the spring of 1988 and will continue for four or five years. The present report describes the initial phase of the project, completed in the fall of 1988.

Norway maple trees at Davenport and Lansdowne (Toronto - Central Region) and green ash trees at Buchanan TS (London - Western Region) were trimmed and trunk injected with uniconazole (XE-1019) in the spring/early summer of 1988. Injection times in the Norway maple were generally short, but much longer in the green ash. Bleeding was observed from some of the injection holes in the maple, while no bleeding was observed in the ash. Little growth (measured as increase in overall height or in trunk diameter) was apparent in the maple and ash trees in the 3 months after injection, with the exception of the increase in overall height of the maples. The effects of uniconazole on the growth of these maple and ash trees will continue to be evaluated over the next few years.

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FIELD EVALUATION OF THE GROWTH REGULATOR UNICONAZOLE (XE-1019)

1.0 INTRODUCTION

Approximately 1 million trees under or beside distribution lines are trimmed or removed by Ontario Hydro every year. The frequency with which trees are trimmed depends on factors such as species, location, orientation to line and rate of regrowth. A reduction in the rate of regrowth would allow the frequency of trimming to be reduced and savings in costs to be achieved.

Growth regulators,such as paclobutrazol(PP-333)[(2RS,3RS) -1-(4-chlorophenyl) -4, 4-dimethyl-2- (1, 2, 4-triazol-1-yl) pentan-3-ol], flurprimidol (EL-300) [α-(1-methylethyl) -α- (4-trifluromethoxy) phenyl] -5- pyrimidine-methanol] and uniconazole (XE-1019) [(E) -1- (4-chlorophenyl) -4, 4-dimethyl-2- (1, 2, 4 - triazol-1-yl) -1- penten-3-ol], have been reported to inhibit tree growth in a number of US and Canadian studies (see for example Arron, 1985, 1986; Sterrett, 1985, 1988; Sterrett and Tworkoski, 1987; Gilliam et al., 1988; Watson, 1987; Watson and Johnston, 1987). Of the various application methods used (eg. trunk injection, bark banding, basal drench, soil injection, foliage application) trunk injection offers advantages over other methods in that chemical contact with non-target plants is prevented and environmental residues are reduced (Sterrett, 1988).

In a field study requested by Distribution Systems Division, trunk injection of the growth regulator uniconazole (XE-1019) is being evaluated as a method of inhibiting growth in trimmed trees growing in southern Ontario. This study was initiated in the spring of 1988 and will continue for four or five years. The present report describes the initial phase of the project, completed in the fall of 1988.

2.0 MATERIALS AND METHODS

2.1 Field Sites

Norway maple (Acer platanoides L.) and green ash (Fraxinus pennsylvanica Marsh.) trees growing at Davenport at Lansdowne (Central Region) and London (Buchanan TS - Western Region), respectively, were used in this study. The two field sites, Davenport at Lansdowne and London, are depicted in Figures 1 and 2, respectively. Both sites are owned by Ontario Hydro.

2.2 Selection of Trees to be Used in Experiment

In a preliminary visit to each site the trees were examined for bark damage and general health, and trunk diameters measured. Trees in poor health, with bark damage, or with particularly large or small trunk diameters were excluded from the study. At each site the trees included in the study were ranked by trunk diameter and paired off (paired comparisons). At the London site separate ranking lists were produced for row 1 and row 2 (trees in row 1 had smaller trunk diameters than trees in row 2) and thus pairing was within rows only. For a given pair one tree was the control and the other the experimental, determined by a coin flip.

2.3 Tree Trimming and Injection

At the Davenport site the twelve Norway maple trees (six experimental and six control) were trimmed flat across the top to a height of 6.1 m (20 ft) on June 16th, 1988. The twenty-four green ash trees at London (twelve experimental and twelve control) were trimmed flat across the top to a height of 6.7 m (22 ft) on June 1st. Trimming trees to give a flat top was not easy for the crews involved. While the major limbs could be trimmed to the appropriate height with some accuracy, the smaller laterals proved more difficult. While this introduced some errors in the overall tree height data, they should prove minor at the conclusion of the experiment when the net increase in height of each tree should be between 1 and 2 m.

The Norway maples and the green ash were injected with uniconazole (0.1 g active ingredient per cm trunk diameter for the former and 0.2 g a.i. per cm diameter for the latter) on June 21st and June 24th respectively. Stock solutions of uniconazole used were 20 g/L for the ash and 10 g/L for the maple (20 g/L stock diluted 1:1 vol:vol with isopropyl alcohol). Injection holes were made at 15 cm intervals around the trunk approximately 15 to 20 cm above soil level. Holes, typically 5 to 6 cm in depth, were made with a Makita drill, fitted with a 5.5 mm (7/32 in) brad point wood bit, at a slight downward angle (about 5^{o} to 10^{o} from the horizontal) and at a 30^{o} to 45^{o} angle to the plane of the trunk to intercept the outer sapwood. Injections were performed with T.I.S. Stallion 75 injectors using an initial pressure of 621 kPa. After injection the holes were sealed with R.T.V. to prevent pathogen entry. Control trees were not injected.

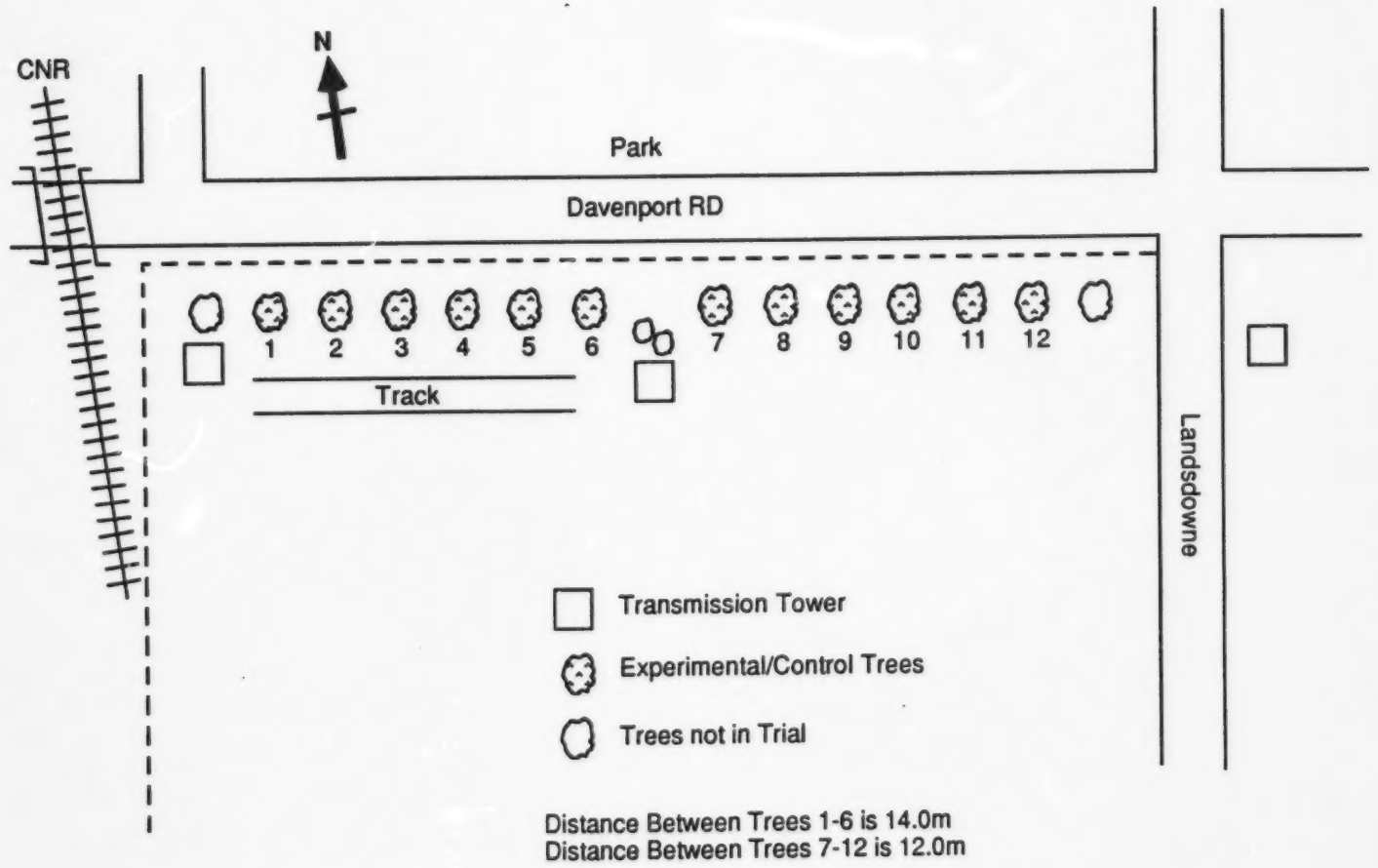

FIGURE 1
DAVENPORT ROAD FIELD TRIAL SITE

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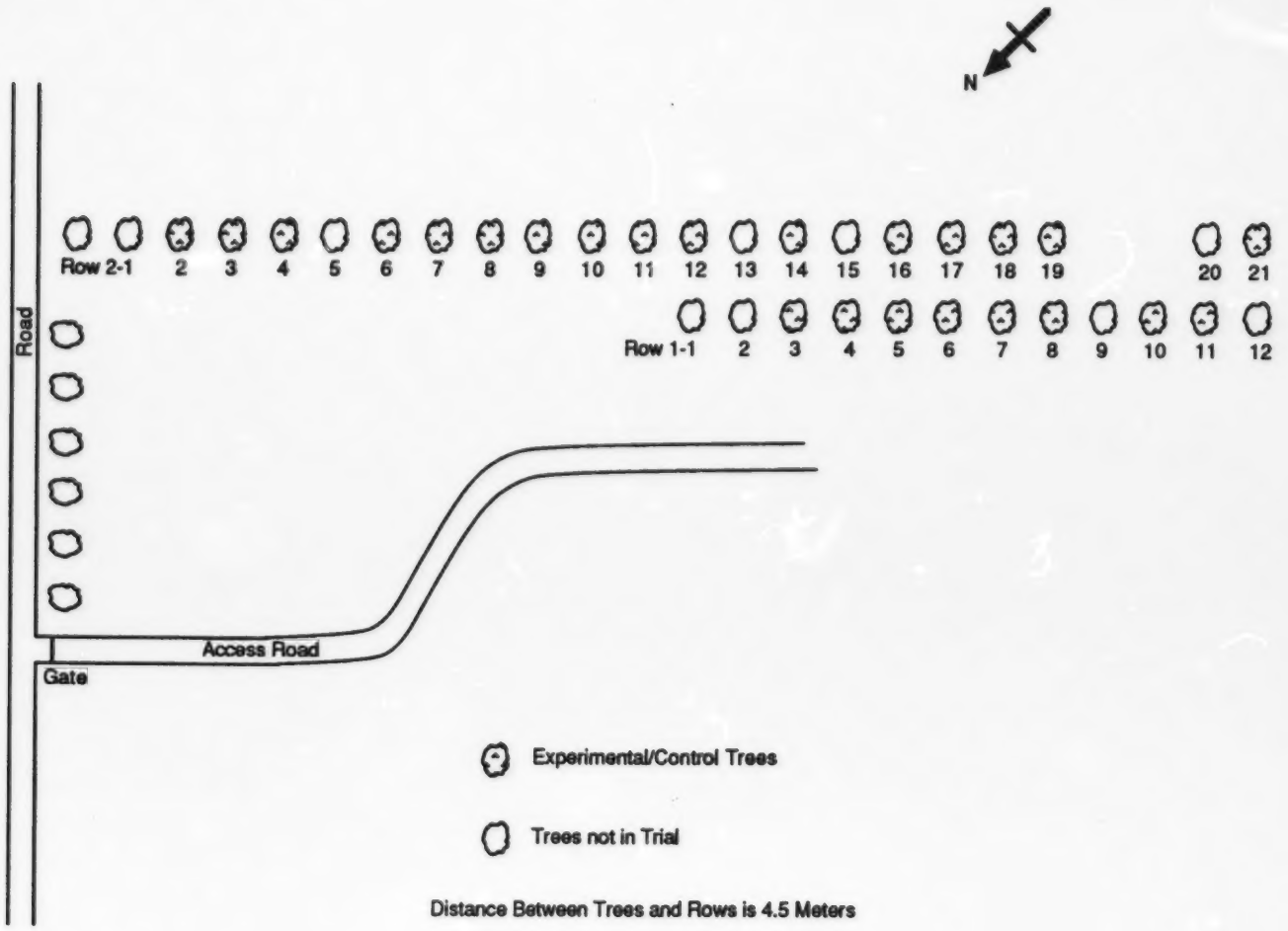

FIGURE 2
LONDON FIELD TRIAL SITE (BUCHANAN T.S.)

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2.4 Measurement of Tree Growth

Overall tree height and trunk diameter were measured in the fall of 1988. Other parameters, i.e. sprout growth above the trim line (using photographs) and changes in leaf size and colour, will be determined from 1989 onwards. Injection holes were checked periodically for bleeding, and the bark above the hole for splitting, in the fall of 1988. The holes and bark will be checked again from 1989 onwards. Bleeding was classified as being slight when the bark around the injection hole was stained. When bleeding was severe blobs of exudate were emitted from the hole.

3.0 RESULTS AND DISCUSSION

The trees injected at London and Davenport are listed in Table 1. Trunk diameters, the number of injection holes and the total volume of growth regulator injected are given. The control trees paired with the experimental (injected) trees are described in brackets. The Norway maple trees at Davenport were larger in trunk diameter than the green ash at London and so required more injection holes and larger injection volumes.

Injection times and the number of holes that bled are given in Table 2. There was some variability in the times for injection since the volume injected per hole varied from tree to tree (see Table 1). Injection times with the Norway maple were short with a mean time of just over 8 minutes. Variability was substantial, with minimum and maximum injection times of 3.4 and 19.4 minutes, respectively. Injection times in the green ash trees were longer, with a mean time of nearly 26 minutes. Again some holes were fast and some extremely slow. Watson (1987) reported an average injection time of 7.3 minutes for Norway maple and 28.2 minutes for white ash. This author also reported an inverse correlation between injection time and temperature. Weather conditions on the 2 days when injections were performed in the present study were clear and sunny with a temperature of approximately 20°C and 28°C at London and Davenport, respectively. Injection times for green ash at a site near Newmarket, Ontario have been reported to be short, i.e. approximately 5 minutes (Smith, 1988), although these trees were injected in September. Watson (1987) found that injections conducted from July to November were the quickest for species in general. Norway maple is a diffuse-porous species while green ash is a ring-porous species. Diffuse-porous species have been reported to take injections more quickly than ring-porous species (Watson, 1987).

No bleeding from the injection holes was observed with the green ash (Table 2). Some of the holes in the Norway maple bled. Bleeding was observed in 6, 3 and 7 holes at 17, 35 and 94 days after injection, respectively. Of these, severe bleeding occurred in 1 hole at 17 days, and 3 holes at 94 days. Bleeding in Norway maple has been reported previously (Curley, 1988). Closure of the injection hole (wound) by callus growth is most rapid in May, June and July, therefore holes that are bleeding in the fall may not close (heal) until the next year (Neeley, 1988). Attention will be paid to injection hole bleeding in the spring of 1989, particularly in the Norway maple, as prior to

budburst root pressure will be high. No bark splitting was observed in either species in 1988; although the bark was lifted around one hole in a Norway maple at the time of injection.

Table 1: Uniconazole Field Trials - Tree Data

Site* injected	Row	Tree	D.b.h. [cm]	Number of Injection Holes	Total volume injected into tree [mL]
London	1	3 (11)+	9.4 (9.7)+	2	100
"	1	6 (5)	12.1 (12.0)	2	120
"	1	7 (8)	10.6 (10.5)	2	110
"	1	10 (4)	12.3 (10.3)	2	120
"	2	4 (8)	12.6 (12.5)	3	135
"	2	9 (18)	15.0 (15.1)	3	150
"	2	11 (10)	14.5 (13.9)	3	135
"	2	14 (7)	12.4 (11.6)	2	120
"	2	16 (12)	17.1 (17.4)	4	180
"	2	17 (6)	15.5 (16.4)	3	150
"	2	19 (3)	16.5 (16.4)	3	165
"	2	21 (2)	14.1 (14.5)	3	135
Davenport	1	2 (1)	27.9 (27.1)	6	270
"	1	4 (3)	27.2 (26.8)	6	270
"	1	5 (6)	24.5 (23.1)	5	250
"	1	7 (10)	16.1 (14.1)	3	165
"	1	8 (11)	17.1 (20.9)	4	180
"	1	9 (12)	22.1 (21.5)	5	225

*All trees at London were green ash and at Davenport Norway maple.
+Tree identified in brackets eg. 11 is control tree paired with experimental tree to left; diameter (d.b.h.) in brackets relates to tree identified in brackets to left. Note: trees are paired within rows only.

Data from measurements of the increase in overall tree height and the increase in trunk diameter are given in Table 3. With the exception of the increase in height of the Norway maple at Davenport, little growth occurred in the three months post trimming. The trees were trimmed late in the growing season and the summer of 1988 was particularly dry. Previous studies have reported little or no effect of growth regulators, such as uniconazole and paclobutrazol, in the first year of treatment (Webster and Quinlan, 1984; Arron, 1988); therefore discussion of the growth data to hand is premature. The late season application of uniconazole and the lag before the product was translocated to the growing points meant that little new foliage formed in the presence of the product and thus effects on foliage size and colour were not apparent.

TABLE 2: UNICONAZOLE FIELD TRIALS - INJECTION TIMES AND NUMBER OF HOLES BLEEDING

Site	Species	Total # of trees injected	Total # of injection holes	Injection time (minutes) Mean injection time per hole	Fastest hole	Slowest hole	# of injection holes bleeding ( ) = days after injection		
London	Green ash	12	32	25.8	2.8	71.8	0 (+10)	0 (+32)	0 (+90)
Davenport	Norway maple	6	29	8.4	3.4	19.4	6 (+17)	3 (+35)	7 (+94)

TABLE 3: GROWTH IN THE YEAR 1988 OF NORWAY MAPLE AND GREEN ASH TREES AFTER TRIMMING AND TRUNK INJECTION WITH UNICONAZOLE

Site	Species	Treatment	Increase in overall height (m)	Increase in trunk diameter (cm)
			- Mean Values -	
London	Green Ash	Control	0.12	0.2
London	Green Ash	Uniconazole	0.10	0.2
Davenport	Norway Maple	Control	0.58	0.4
Davenport	Norway Maple	Uniconazole	0.34	0.2

4.0 CONCLUSIONS

1. Norway maple trees at Davenport and Lansdowne and green ash trees at Buchanan TS (London) were successfully trimmed and trunk injected with the growth regulator uniconazole (XE-1019) in the spring/early summer of 1988.

2. Injection times in the Norway maple were generally short, while in the green ash they were much longer (mean time of 8 and 26 minutes, respectively).

3. Bleeding from some of the injection holes in the Norway maple was observed up to 94 days after injection. No bleeding was observed in the ash.

4. Little growth was observed in the maple and ash trees in the 3 months after injection, with the exception of the increase in overall height of the maples.

5. The effects of uniconazole on the growth of the maple and ash trees will continue to be monitored over the next few years.

ACKNOWLEDGMENTS

The following personnel are to be thanked for their assistance in the identification of field sites and the completion of the trimming exercises: R.A. McHugh, M.L. Della Rosa, J. Kirkpatrick, K. Allardyce, I. Gibson and D. Killingsworth. Excellent technical assistance was provided by A. Spring. Uniconazole was provided (gratis) by Valent USA Corporation (formerly Chevron Chemical Company) and the T.I.S. Stallion 75 injector system was supplied (gratis) by Fonds de Recherches et de Developpement Forestier inc., St-Romuald, PQ.

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